Detail 113, Flow/Timing Stanislaus River

Step 1. Quantified Targets

A. Fish Flow Targets for the Stanislaus River (from upper reach to San Joaquin River)

      source: CALFED Ecosystem Restoration Program Plan   Thousand Acre Feet

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
1) Critical	15.3	13.9	15.3	53.8	53.8	11.9	12.3	12.3	11.9	12.3	14.9	15.3	242.8
2) Dry	16.9	15.2	16.9	53.8	53.8	11.9	12.3	12.3	11.9	15.3	16.3	16.9	253.4
3) B Norm	18.4	16.6	18.4	71.6	71.6	14.9	15.3	15.3	14.9	15.3	17.8	18.4	308.6
4) A Norm	21.5	19.4	21.5	89.1	92.1	47.5	18.4	18.4	17.8	21.5	20.8	21.5	409.5
5) Wet	24.6	22.2	24.6	89.1	92.1	89.1	18.4	18.4	17.8	21.5	23.8	24.6	466.0
Average	18.9	17.1	18.9	69.9	71.0	32.4	15.1	15.1	14.6	16.9	18.3	18.9	327.3

B. Additional Flow Requirements to Meet Water Quality Permit at Vernalis on the S. Joaquin R. (TB# 123)

      source: USBR Planning Unit   Thousand Acre Feet

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
1) Critical	0.0	0.0	0.0	6.0	1.0	39.0	30.0	20.0	0.0	4.0	0.0	0.0	100.0
2) Dry	0.0	1.0	1.0	6.0	0.0	34.0	38.0	28.0	0.0	2.0	0.0	0.0	110.0
3) B Norm	0.0	0.0	0.0	3.0	0.0	28.0	41.0	38.0	1.0	1.0	0.0	0.0	112.0
4) A Norm	0.0	0.0	0.0	0.0	0.0	0.0	22.0	24.0	0.0	0.0	0.0	0.0	46.0
5) Wet	0.0	0.0	0.0	0.0	0.0	0.0	8.0	19.0	0.0	1.0	0.0	0.0	28.0
Average	0.0	0.2	0.2	3.3	0.3	21.5	28.1	25.2	0.2	1.8	0.0	0.0	80.7

C. Combined Flow Requirements for Fish and Water Quality

      source: calculated = Step 1A. + Step 1B.   Thousand Acre Feet

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
1) Critical	15.3	13.9	15.3	59.8	54.8	50.9	42.3	32.3	11.9	16.3	14.9	15.3	342.8
2) Dry	16.9	16.2	17.9	59.8	53.8	45.9	50.3	40.3	11.9	17.3	16.3	16.9	363.4
3) B Norm	18.4	16.6	18.4	74.6	71.6	42.9	56.3	53.3	15.9	16.3	17.8	18.4	420.6
4) A Norm	21.5	19.4	21.5	89.1	92.1	47.5	40.4	42.4	17.8	21.5	20.8	21.5	455.5
5) Wet	24.6	22.2	24.6	89.1	92.1	89.1	26.4	37.4	17.8	22.5	23.8	24.6	494.0
Average	18.9	17.3	19.2	73.2	71.3	53.9	43.2	40.3	14.8	18.6	18.3	18.9	408.0

Step 2. Reference Condition

A. Stanislaus River Flow (1922-1990) at Goodwin Dam

      source: CVGSM   Thousand Acre Feet

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
1) Critical	12.3	14.2	36.3	62.0	75.4	76.7	63.8	51.4	33.6	10.6	10.3	15.6	462.3
2) Dry	26.0	34.9	52.3	119.8	158.9	115.9	83.9	68.4	38.1	14.8	10.0	41.0	763.9
3) B Norm	47.5	51.1	67.5	154.4	233.9	150.2	80.4	70.3	45.0	17.7	28.3	57.1	1003.4
4) A Norm	55.8	77.0	146.1	188.1	267.8	162.9	93.3	72.3	38.3	23.8	11.6	29.4	1166.4
5) Wet	103.7	100.4	132.9	191.7	301.3	239.9	124.3	105.1	75.5	41.8	28.9	49.8	1495.2
Average	44.7	51.7	83.8	136.5	195.4	141.1	86.6	71.0	44.0	20.4	16.3	35.8	927.5

B. Stanislaus Diversions (1980-1989) Primarily Taken Out at Oakdale and South San Joaquin
source: CVGSM   Thousand Acre Feet

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
1) Critical	5.0	7.6	20.0	52.7	59.0	57.8	58.8	50.8	31.7	10.7	1.6	1.6	357.3
2) Dry	7.8	5.1	16.2	56.5	75.0	71.3	67.0	56.9	31.7	16.7	1.8	0.9	406.9
3) B Norm	2.9	7.9	16.3	46.4	69.5	74.5	72.8	65.6	43.5	14.2	2.0	0.7	416.5
4) A Norm	1.4	6.6	16.1	45.4	75.7	77.9	75.9	65.8	44.4	17.0	3.5	1.0	430.6
5) Wet	3.4	2.6	11.9	41.1	74.0	81.9	84.5	83.0	56.4	13.7	2.4	2.9	457.8
Average	4.2	6.1	16.5	49.0	69.9	71.4	70.5	62.8	40.3	14.3	2.2	1.4	408.7

C. Reference Condition for Reach Below Oakdale and South San Joaquin Diversions
source: calculated = Step 2A. - Step 2B.   Thousand Acre Feet

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
1) Critical	7.4	6.6	16.4	9.3	16.4	18.9	5.0	0.6	1.8	-0.1	8.6	14.1	104.9
2) Dry	18.2	29.8	36.0	63.2	83.9	44.6	16.9	11.5	6.5	-1.9	8.2	40.1	357.0
3) B Norm	44.6	43.2	51.2	107.9	164.4	75.7	7.6	4.6	1.5	3.5	26.3	56.4	586.9
4) A Norm	54.4	70.4	130.1	142.7	192.1	85.0	17.4	6.5	-6.0	6.8	8.1	28.4	735.9
5) Wet	100.3	97.8	121.0	150.6	227.3	158.0	39.8	22.1	19.1	28.1	26.5	46.9	1037.4
Average	40.5	45.6	67.3	87.5	125.5	69.7	16.1	8.2	3.7	6.1	14.1	34.4	518.7

Step 3. Quantified Targeted Benefit Change

A. Quantified Targeted Benefit Change
source: calculated = Step 1C. - Step 2C.   Thousand Acre Feet

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
1) Critical	8.0	7.3	0.0	50.4	38.3	32.0	37.3	31.6	10.1	16.3	6.2	1.3	238.9
2) Dry	0.0	0.0	0.0	0.0	0.0	1.3	33.4	28.8	5.4	19.3	8.1	0.0	96.3
3) B Norm	0.0	0.0	0.0	0.0	0.0	0.0	48.7	48.7	14.4	12.8	0.0	0.0	124.6
4) A Norm	0.0	0.0	0.0	0.0	0.0	0.0	23.0	35.9	23.9	14.7	12.7	0.0	110.1
5) Wet	0.0	0.0	0.0	0.0	0.0	0.0	0.0	15.4	0.0	0.0	0.0	0.0	15.4
Average	2.1	1.9	0.0	13.2	10.0	8.6	29.3	32.1	11.2	13.4	6.0	0.3	128.1

Step 4. Streamflow Data Conversion

A. Total Diversions Sub-Region 11
source: CVGSM

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
1) Critical	8.9	12.1	39.3	85.6	91.8	95.0	98.2	84.0	48.1	23.5	7.1	6.7	600.3
2) Dry	10.2	8.4	32.7	96.5	122.9	116.9	109.7	95.0	55.6	32.6	6.6	4.8	691.9
3) B Norm	6.2	10.1	33.6	81.6	119.4	127.1	120.8	107.3	72.5	19.8	5.0	2.7	706.1
4) A Norm	2.2	11.5	31.6	79.8	127.7	131.6	123.3	107.4	73.5	44.1	13.8	6.6	753.3
5) Wet	4.7	3.2	18.8	70.9	121.2	137.2	139.4	126.7	91.4	28.1	13.2	11.0	766.0
Average	6.6	9.5	32.1	83.6	115.0	119.2	116.2	101.8	65.9	30.0	9.1	6.3	695.4

B. Stanislaus:Sub-Region 11 Streamflow Diversion Ratio
source: calculated = Step 2B./Step 4A

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1) Critical	0.56	0.63	0.51	0.62	0.64	0.61	0.6	0.61	0.66	0.46	0.23	0.23
2) Dry	0.76	0.60	0.50	0.59	0.61	0.61	0.61	0.60	0.57	0.51	0.27	0.19
3) B Norm	0.47	0.78	0.49	0.57	0.58	0.59	0.60	0.61	0.60	0.72	0.39	0.27
4) A Norm	0.61	0.57	0.51	0.57	0.59	0.59	0.62	0.61	0.60	0.39	0.25	0.16
5) Wet	0.72	0.81	0.63	0.58	0.61	0.60	0.61	0.66	0.62	0.49	0.18	0.26
Average	0.62	0.66	0.52	0.59	0.61	0.60	0.61	0.61	0.61	0.50	0.26	0.22

CALFED Agricultural Water Use Efficiency
DRAFT Explanations and Examples of Targeted Benefits and Quantifiable Objectives

C-32

Step 5. Water Flow Path Elements

A. Farm Rain Sub-Region 11 * Step 4B. (inflow)   Flow Path Not Affected
        source: CVGSM Sub-Region 11   Thousand Acre Feet

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
1) Critical	15.6	12.9	8.3	7.2	4.2	1.4	0.0	0.5	1.7	2.9	3.4	4.9	63.1
2) Dry	19.2	15.4	14.8	6.8	4.5	0.5	0.1	0.2	2.6	5.9	4.9	4.2	79.1
3) B Norm	16.8	28.7	12.8	11.1	3.9	0.5	0.0	0.2	0.4	5.8	12.0	9.0	101.1
4) A Norm	21.9	21.0	18.3	11.2	1.6	0.6	0.6	0.9	1.2	5.3	6.7	6.8	96.1
5) Wet	39.4	36.8	29.2	20.3	3.2	0.7	0.8	0.2	4.5	6.6	5.3	12.9	160.0
Average	21.7	21.5	15.9	10.7	3.5	0.8	0.3	0.4	2.0	5.1	6.1	7.1	95.0

B. Ground Water Diversions Sub-Region 11 * Step 4B. (inflow)
        source: CVGSM Sub-Region 11   Thousand Acre Feet

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
1) Critical	0.6	0.6	7.7	5.9	6.5	8.3	8.3	3.2	0.0	2.9	0.4	0.3	44.8
2) Dry	0.7	0.3	2.3	3.0	3.9	8.2	8.2	3.1	0.0	2.7	0.4	0.4	33.1
3) B Norm	0.5	0.4	1.7	2.7	3.6	7.8	8.3	3.1	0.0	3.7	0.5	0.5	32.7
4) A Norm	0.5	0.3	1.2	2.6	3.6	7.7	8.3	3.0	0.0	2.0	0.4	0.2	29.9
5) Wet	0.4	0.6	1.5	2.6	3.7	7.8	7.8	3.2	0.0	2.3	0.3	0.3	30.6
Average	0.6	0.5	3.3	3.6	4.4	8.0	8.2	3.1	0.0	2.7	0.4	0.3	35.0

C. ETAW Sub-Region 11 * Step 4B. (outflow)   Flow Path Not Affected
        source: calculated   Thousand Acre Feet

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
1) Critical	0.3	0.9	9.5	25.6	48.3	59.8	65.2	56.8	41.9	13.5	1.6	0.6	323.9
2) Dry	0.6	0.8	4.7	24.1	46.1	61.8	68.9	57.9	35.6	14.0	2.0	0.0	316.5
3) B Norm	0.1	0.6	5.9	20.0	44.5	59.5	68.0	59.1	39.0	20.3	2.1	0.3	319.4
4) A Norm	0.3	0.5	4.5	20.0	47.5	60.4	69.0	58.6	38.5	9.8	0.8	0.1	310.0
5) Wet	0.0	0.5	5.4	14.3	47.5	60.4	67.7	63.2	36.8	12.4	0.4	0.0	308.6
Average	0.3	0.7	6.2	21.4	47.0	60.4	67.6	58.8	38.6	13.7	1.4	0.2	316.2

D. Farm Surface Water Return Sub-Region 11 * Step 4B. (outflow, recoverable)
        source: calculated   Thousand Acre Feet

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
1) Critical	0.0	0.0	3.5	9.1	11.1	12.3	12.4	10.8	8.3	2.8	0.6	0.4	71.2
2) Dry	0.0	0.0	2.6	9.2	11.4	13.7	14.3	12.1	8.2	3.2	0.8	0.3	75.8
3) B Norm	0.0	0.0	2.6	9.2	11.3	13.2	14.6	12.8	8.7	4.3	1.0	0.4	78.0
4) A Norm	0.0	0.0	2.5	9.2	11.5	13.4	14.9	12.8	8.8	2.4	0.8	0.3	76.4
5) Wet	0.0	0.0	3.1	9.3	11.8	13.5	14.7	13.7	9.0	2.9	0.5	0.4	78.8
Average	0.0	0.0	2.9	9.2	11.4	13.1	14.0	12.3	8.5	3.0	0.7	0.4	75.5

E. Farm Runoff from Rain Sub-Region 11 * Step 4B. (outflow, irrecoverable)   Flow Path Not Affected
        source: calculated   Thousand Acre Feet

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
1) Critical	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2
2) Dry	0.3	0.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.7
3) B Norm	0.6	0.6	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.2	1.7
4) A Norm	0.5	0.5	0.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.2	1.6
5) Wet	1.6	1.7	1.4	0.4	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.5	5.6
Average	0.5	0.6	0.3	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	1.7

F. Farm Ground Water Flow Sub-Region 11 * Step 4B. (outflow, recoverable)

source: calculated — Thousand Acre Feet

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
1) Critical	10.5	6.2	12.5	27.6	15.2	9.2	5.5	4.8	4.5	1.7	2.3	4.5	104.4
2) Dry	12.8	8.1	13.7	29.3	19.5	15.9	13.0	12.4	10.8	3.7	3.8	4.3	147.3
3) B Norm	12.1	20.1	12.3	34.8	20.0	17.4	15.1	14.9	10.9	3.0	9.5	8.9	179.0
4) A Norm	16.1	13.8	17.0	35.1	18.5	17.7	16.3	15.6	11.9	3.6	6.3	6.9	178.7
5) Wet	31.4	26.5	27.0	43.9	20.5	17.9	16.0	16.0	15.0	4.4	4.8	12.9	236.4
Average	15.8	13.7	16.0	33.3	18.4	15.1	12.6	12.1	10.1	3.2	5.0	7.0	162.2

G. Surface Water Diversions Sub-Region 11 * Step 4B. (inflow)

source: CVGSM Sub-Region 11 — Thousand Acre Feet

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
1) Critical	1.2	1.4	16.1	55.3	68.2	72.8	74.7	68.6	51.1	14.8	3.1	2.4	429.7
2) Dry	1.7	1.6	14.8	59.2	73.0	83.2	88.2	79.5	51.2	17.1	4.0	2.1	475.7
3) B Norm	1.0	2.1	15.8	59.7	72.1	82.5	89.7	83.9	56.0	23.4	5.4	2.9	494.6
4) A Norm	1.4	1.5	16.0	60.0	73.9	83.9	92.2	84.1	56.4	13.0	3.9	1.9	488.2
5) Wet	1.9	2.0	19.8	61.0	76.1	84.5	91.0	89.5	57.5	16.4	2.6	3.2	505.6
Average	1.4	1.7	16.4	58.7	72.3	80.7	86.2	79.9	54.1	16.5	3.7	2.4	474.2

H. District Surface and Ground Water Return Flows * Step 4B. (outflow)

source: CVGSM — Thousand Acre Feet

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
1) Critical	0.8	0.9	3.9	14.9	18.0	19.3	19.6	18.7	13.2	3.4	1.5	1.2	115.4
2) Dry	1.2	2.1	4.1	17.2	19.2	22.2	23.6	22.5	13.7	4.0	2.1	0.8	132.7
3) B Norm	0.7	2.4	5.8	16.9	20.0	22.5	23.5	23.8	15.4	5.5	2.9	1.3	140.6
4) A Norm	1.2	1.6	5.9	17.7	20.7	23.2	24.4	23.6	15.9	3.1	2.0	1.0	140.2
5) Wet	2.2	1.8	7.1	18.3	21.7	23.4	25.3	25.2	16.1	3.9	1.3	1.9	148.2
Average	1.2	1.7	5.2	16.9	19.7	21.9	23.0	22.4	14.7	3.9	1.9	1.2	133.6

I. District Evaporation Flows * Step 4B. (outflow)

source: CVGSM — Thousand Acre Feet

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
1) Critical	0.2	0.2	0.8	3.1	3.8	4.1	4.1	4.0	2.8	0.7	0.3	0.2	24.3
2) Dry	0.2	0.4	0.9	3.6	4.0	4.6	5.0	4.7	2.9	0.8	0.4	0.2	27.7
3) B Norm	0.1	0.5	1.2	3.5	4.2	4.7	4.9	5.0	3.2	1.2	0.6	0.3	29.3
4) A Norm	0.2	0.3	1.2	3.7	4.3	4.8	5.1	4.9	3.3	0.7	0.4	0.2	29.2
5) Wet	0.4	0.4	1.5	3.8	4.5	4.9	5.3	5.3	3.4	0.8	0.3	0.4	30.8
Average	0.2	0.3	1.1	3.5	4.1	4.6	4.8	4.7	3.1	0.8	0.4	0.2	27.9

Step 6. Idealized Agricultural Potential (Farm and District)

A. Idealized Agricultural Potential (Farm)

source: calculated = Step 5D. + Step 5F. — Thousand Acre Feet

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
1) Critical	10.5	6.2	16.0	36.7	26.3	21.5	18.0	15.5	12.8	4.5	2.8	4.9	175.6
2) Dry	12.8	8.1	16.3	38.5	30.9	29.6	27.3	24.6	18.9	6.9	4.6	4.6	223.1
3) B Norm	12.1	20.1	14.9	44.0	31.3	30.6	29.7	27.7	19.6	7.4	10.5	9.3	257.0
4) A Norm	16.1	13.8	19.5	44.2	30.0	31.0	31.1	28.5	20.7	6.0	7.0	7.1	255.0
5) Wet	31.4	26.5	30.1	53.2	32.3	31.4	30.6	29.8	24.0	7.2	5.3	13.4	315.1
Average	15.8	13.7	18.9	42.5	29.8	28.2	26.6	24.4	18.6	6.2	5.7	7.4	237.7

CALFED Agricultural Water Use Efficiency
DRAFT Explanations and Examples of Targeted Benefits and Quantifiable Objectives

C-34

B. Idealized Agricultural Potential (District)

source: calculated = Step 5H. + Step 5I.　　　　　　　　　　　　　　　Thoudand Acre Feet

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
1) Critical	0.9	1.1	4.8	18.0	21.7	23.4	23.7	22.7	16.0	4.1	1.8	1.4	139.7
2) Dry	1.5	2.5	4.9	20.7	23.2	26.9	28.6	27.2	16.6	4.9	2.5	0.9	160.5
3) B Norm	0.9	2.8	7.0	20.4	24.1	27.1	28.4	28.8	18.6	6.6	3.4	1.5	169.8
4) A Norm	1.5	2.0	7.2	21.4	25.0	28.0	29.5	28.5	19.2	3.7	2.4	1.1	169.4
5) Wet	2.6	2.1	8.6	22.1	26.2	28.3	30.6	30.5	19.4	4.7	1.5	2.3	179.0
Average	1.4	2.0	6.3	20.3	23.8	26.5	27.8	27.1	17.8	4.7	2.3	1.4	161.4

Step 7. Farm Quantifiable Objective Component

A. EXISTING Farm Efficiency = ETAW/(ETAW + Idealized Agricultural Potential)

source: calculated = Step 5C./(Step 5C. + Step 6A.)　　　　　　　　　　Irrigation Season

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Average
1) Critical	---	---	0.37	0.41	0.65	0.74	0.8	0.79	0.77	0.75	---	---	0.68
2) Dry	---	---	0.22	0.38	0.60	0.68	0.72	0.70	0.65	0.67	---	---	0.62
3) B Norm	---	---	0.28	0.31	0.59	0.66	0.70	0.68	0.67	0.73	---	---	0.61
4) A Norm	---	---	0.19	0.31	0.61	0.66	0.69	0.67	0.65	0.62	---	---	0.59
5) Wet	---	---	0.15	0.21	0.60	0.66	0.69	0.68	0.61	0.63	---	---	0.56
Average	---	---	0.25	0.33	0.61	0.68	0.72	0.71	0.67	0.69	---	---	0.62

HIGH and VERY HIGH efficiency levels are based on shifting the irrigation systems in the most cost effec manner for the various crop categories. The reference used to develop irrigation system efficiencies was the Performance Cost Study prepared for the PEIS of the CVPIA in 1994.

B. HIGH Farm Efficiency at 75% Overall Efficiency

source: calculated to give overall efficiency using a max efficiency of 85%　　　　Irrigation Season

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Average
1) Critical	---	---	0.50	0.55	0.79	0.85	0.85	0.85	0.85	0.85	---	---	0.79
2) Dry	---	---	0.30	0.51	0.73	0.82	0.85	0.85	0.79	0.81	---	---	0.76
3) B Norm	---	---	0.38	0.42	0.71	0.80	0.85	0.83	0.81	0.85	---	---	0.75
4) A Norm	---	---	0.25	0.42	0.75	0.80	0.84	0.82	0.79	0.75	---	---	0.73
5) Wet	---	---	0.20	0.28	0.72	0.80	0.84	0.83	0.74	0.77	---	---	0.70
Average	---	---	0.34	0.45	0.74	0.82	0.85	0.84	0.80	0.81	---	---	0.75

C. HIGH Available Agricultural Potential after improving from existing Eff to 75% Eff

If Rain > Diversion then monthly value of available water is set to 0 (this assumes irrigation is negligible)

source: calculated = Step 5C./Step 7A. - Step 5C./Step 7B.　　　　　　　Thousand Acre Feet

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
1) Critical	---	---	6.4	15.7	13.3	10.9	6.5	5.5	5.4	2.1	---	---	65.9
2) Dry	---	---	5.3	15.8	13.7	16.3	15.2	14.3	9.7	3.7	---	---	94.1
3) B Norm	---	---	5.3	16.2	13.5	16.1	17.4	15.5	10.4	3.8	---	---	98.1
4) A Norm	---	---	0.0	16.2	13.8	16.3	17.8	15.5	10.6	2.8	---	---	93.1
5) Wet	---	---	0.0	17.1	14.2	16.4	17.5	16.6	10.8	3.5	---	---	96.1
Average	---	---	3.6	16.2	13.7	14.9	14.2	12.8	9.1	3.1	---	---	87.5

CALFED Agricultural Water Use Efficiency
DRAFT Explanations and Examples of Targeted Benefits and Quantifiable Objectives

C-35

D. HIGH Additional Potential from Reoperation of Reservoir @ 75% Efficiency
source: calculated based on Step 3A.; Step 7C.   Thousand Acre Feet

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
1) Critical	---	---	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	---	---	0.0
2) Dry	---	---	0.0	0.0	0.0	7.5	0.0	0.0	4.3	0.0	---	---	11.8
3) B Norm	---	---	0.0	0.0	0.0	8.0	0.0	0.0	0.0	0.0	---	---	8.0
4) A Norm	---	---	0.0	0.0	0.0	8.1	0.0	0.0	0.0	0.0	---	---	8.1
5) Wet	---	---	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	---	---	0.0
Average	---	---	0.0	0.0	0.0	4.6	0.0	0.0	0.9	0.0	---	---	5.4

E. VERY HIGH Farm Efficiency at 87% Overall Efficiency
source: calculated to give overall efficiency using a max efficiency of 92%   Irrigation

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Season
1) Critical	---	---	0.70	0.78	0.92	0.92	0.9	0.92	0.92	0.92	---	---	0.90
2) Dry	---	---	0.42	0.73	0.92	0.92	0.92	0.92	0.92	0.92	---	---	0.89
3) B Norm	---	---	0.54	0.59	0.92	0.92	0.92	0.92	0.92	0.92	---	---	0.88
4) A Norm	---	---	0.36	0.59	0.92	0.92	0.92	0.92	0.92	0.92	---	---	0.87
5) Wet	---	---	0.29	0.40	0.92	0.92	0.92	0.92	0.92	0.92	---	---	0.84
Average	---	---	0.48	0.64	0.92	0.92	0.92	0.92	0.92	0.92	---	---	0.87

F. VERY HIGH Available Agricultural Potential after improving from existing Eff to 87% Eff
If Rain > Diversion then monthly value of available water is set to 0 (this assumes irrigation is negligible)
source: calculated = Step 5C./Step 7A. - Step 5C./Step 7E.   Thousand Acre Feet

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
1) Critical	---	---	12.0	29.3	22.1	16.3	12.3	10.6	9.2	3.3	---	---	115.1
2) Dry	---	---	9.9	29.5	26.9	24.2	21.4	19.5	15.9	5.7	---	---	152.9
3) B Norm	---	---	9.8	30.2	27.4	25.4	23.8	22.6	16.2	5.6	---	---	160.9
4) A Norm	---	---	0.0	30.3	25.9	25.8	25.2	23.4	17.3	5.1	---	---	152.9
5) Wet	---	---	0.0	31.9	28.2	26.1	24.7	24.3	20.8	6.2	---	---	162.1
Average	---	---	6.7	30.1	25.7	23.0	20.7	19.3	15.3	5.0	---	---	145.8

G. VERY HIGH Additional Potential from Reoperation of Reservoir @ 87% Efficiency
source: calculated based on Step 3A., Step 7F.   Thousand Acre Feet

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
1) Critical	---	---	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	---	---	0.0
2) Dry	---	---	0.0	0.0	0.0	11.5	0.0	0.0	10.4	0.0	---	---	21.9
3) B Norm	---	---	0.0	0.0	0.0	12.7	0.0	0.0	1.9	0.0	---	---	14.6
4) A Norm	---	---	0.0	0.0	0.0	12.9	2.2	0.0	0.0	0.0	---	---	15.1
5) Wet	---	---	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	---	---	0.0
Average	---	---	0.0	0.0	0.0	7.2	0.5	0.0	2.4	0.0	---	---	10.0

Step 8. District Quantifiable Objective Component

A. EXISTING District Loss Fraction
source: calculated = (Step 5H. + Step 5I.)/Step 2B.   Irrigation

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Season
1) Critical	---	---	0.24	0.34	0.37	0.40	0.4	0.45	0.50	0.38	---	---	0.39
2) Dry	---	---	0.30	0.37	0.31	0.38	0.43	0.48	0.53	0.29	---	---	0.39
3) B Norm	---	---	0.43	0.44	0.35	0.36	0.39	0.44	0.43	0.47	---	---	0.41
4) A Norm	---	---	0.45	0.47	0.33	0.36	0.39	0.43	0.43	0.22	---	---	0.39
5) Wet	---	---	0.73	0.54	0.35	0.35	0.36	0.37	0.34	0.35	---	---	0.39
Average	---	---	0.41	0.42	0.34	0.37	0.40	0.44	0.46	0.34	---	---	0.39

HIGH and VERY HIGH Disrtict efficiencies were developed based on existing district improvement proje
Projects include the Imperial Irrigation District - Metroploitan Water District and a similar, ongoing projec
designed to improve river flows in the Columbia River Basin.

B. HIGH Available Agricultural Potential @ 18% Loss (Allows10% Seep+Evap & 8% Leak+Spill Losses)
source: calculated = Step 2B * Step 8A. - Step 2B.*0.18 (HIGH Dist.) Thousand Acre Feet

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
1) Critical	---	---	1.2	8.5	11.1	13.0	13.2	13.6	10.3	2.2	---	---	73.0
2) Dry	---	---	2.0	10.6	9.7	14.0	16.5	16.9	10.9	1.8	---	---	82.5
3) B Norm	---	---	4.1	12.0	11.6	13.7	15.3	17.0	10.8	4.1	---	---	88.6
4) A Norm	---	---	4.3	13.2	11.3	14.0	15.8	16.7	11.2	0.7	---	---	87.2
5) Wet	---	---	6.5	14.7	12.9	13.6	15.4	15.5	9.3	2.3	---	---	90.1
Average	---	---	3.3	11.5	11.3	13.6	15.1	15.8	10.5	2.1	---	---	83.2

C. HIGH District Quantified Objective @ 18% Loss
source: calculated = minimum(Step 3A., Step 8A.) Thousand Acre Feet

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
1) Critical	---	---	0.0	8.5	11.1	13.0	13.2	13.6	10.1	2.2	---	---	71.6
2) Dry	---	---	0.0	0.0	0.0	1.3	16.5	16.9	5.4	1.8	---	---	42.0
3) B Norm	---	---	0.0	0.0	0.0	0.0	15.3	17.0	10.8	4.1	---	---	47.1
4) A Norm	---	---	0.0	0.0	0.0	0.0	15.8	16.7	11.2	0.7	---	---	44.4
5) Wet	---	---	0.0	0.0	0.0	0.0	0.0	15.4	0.0	0.0	---	---	15.4
Average	---	---	0.0	2.2	2.9	3.6	12.6	15.8	7.9	1.7	---	---	46.8

C. HIGH Additional Potential from Reservoir Repoeration Quantified Objective @ 18% Loss
source: calculated based on Step 3A., Step 8B. Thousand Acre Feet

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
1) Critical	---	---	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.0	---	---	0.2
2) Dry	---	---	0.0	0.0	0.0	6.4	0.0	0.0	5.5	0.0	---	---	11.9
3) B Norm	---	---	0.0	0.0	0.0	6.9	0.0	0.0	0.0	0.0	---	---	6.9
4) A Norm	---	---	0.0	0.0	0.0	7.0	0.0	0.0	0.0	0.0	---	---	7.0
5) Wet	---	---	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	---	---	0.0
Average	---	---	0.0	0.0	0.0	3.9	0.0	0.0	1.2	0.0	---	---	5.1

D. VERY HIGH Available Agricultural Potential @ 8% Loss (Allows 4% Seep+Evap & 4% Leak+Spill Loss
source: calculated = Step 2B. * Step 8A. - Step 2B.*0.08 (VERY HIGH Dist.)Thousand Acre Feet

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
1) Critical	---	---	3.2	13.8	17.0	18.7	19.0	18.6	13.5	3.2	---	---	107.1
2) Dry	---	---	3.6	16.2	17.2	21.2	23.2	22.6	14.1	3.5	---	---	121.7
3) B Norm	---	---	5.7	16.7	18.6	21.2	22.5	23.6	15.1	5.5	---	---	128.9
4) A Norm	---	---	5.9	17.8	18.9	21.8	23.4	23.3	15.6	2.4	---	---	129.0
5) Wet	---	---	7.7	18.8	20.3	21.8	23.8	23.8	14.9	3.6	---	---	134.7
Average	---	---	5.0	16.4	18.2	20.8	22.1	22.1	14.6	3.5	---	---	122.7

E. VERY HIGH Additional Potential from Reservoir Repoeration Quantified Objective @ 8% Loss
source: calculated based on Step 3A., Step 8D. Thousand Acre Feet

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
1) Critical	---	---	0.0	0.0	0.0	0.0	0.0	0.0	3.4	0.0	---	---	3.4
2) Dry	---	---	0.0	0.0	0.0	9.9	0.0	0.0	8.7	0.0	---	---	18.6
3) B Norm	---	---	0.0	0.0	0.0	10.6	0.0	0.0	0.0	0.0	---	---	10.6
4) A Norm	---	---	0.0	0.0	0.0	10.9	0.4	0.0	0.0	0.0	---	---	11.3
5) Wet	---	---	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	---	---	0.0
Average	---	---	0.0	0.0	0.0	6.1	0.1	0.0	2.7	0.0	---	---	8.8

CALFED Agricultural Water Use Efficiency
DRAFT Explanations and Examples of Targeted Benefits and Quantifiable Objectives

C-37

Step 9. Combined Farm + District Quantifiable Objective

A. Improvement Level 1; EXISTING Farm + HIGH District
source: calculated = minimum(Step 3A, Step 8B.)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total Total
1) Critical	---	---	0.0	8.5	11.1	13.0	13.2	13.6	10.1	2.2	---	---	71.6
2) Dry	---	---	0.0	0.0	0.0	1.3	16.5	16.9	5.4	1.8	---	---	42.0
3) B Norm	---	---	0.0	0.0	0.0	0.0	15.3	17.0	10.8	4.1	---	---	47.1
4) A Norm	---	---	0.0	0.0	0.0	0.0	15.8	16.7	11.2	0.7	---	---	44.4
5) Wet	---	---	0.0	0.0	0.0	0.0	0.0	15.4	0.0	0.0	---	---	15.4
Average	---	---	0.0	2.2	2.9	3.6	12.6	15.8	7.9	1.7	---	---	46.8

B. Improvement Level 2; HIGH Farm + HIGH District
source: calculated = minimum(Step 3A,Step 7C. + Step 8B.)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Season Total
1) Critical	---	---	0.0	24.3	24.4	23.9	19.6	19.1	10.1	4.3	---	---	125.6
2) Dry	---	---	0.0	0.0	0.0	1.3	31.7	28.8	5.4	5.6	---	---	72.8
3) B Norm	---	---	0.0	0.0	0.0	0.0	32.7	32.5	14.4	7.9	---	---	87.4
4) A Norm	---	---	0.0	0.0	0.0	0.0	23.0	32.2	21.7	3.5	---	---	80.4
5) Wet	---	---	0.0	0.0	0.0	0.0	0.0	15.4	0.0	0.0	---	---	15.4
Average	---	---	0.0	6.3	6.4	6.8	24.1	28.4	11.2	4.3	---	---	87.4

C. Impovement Level 3; HIGH Farm + VERY HIGH District
source: calculated = minimum(Step 3A, Step 7C. + Step 8D.)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Thousand Acre Feet Total
1) Critical	---	---	0.0	29.5	30.3	29.7	25.5	24.2	10.1	5.3	---	---	154.6
2) Dry	---	---	0.0	0.0	0.0	1.3	33.4	28.8	5.4	7.2	---	---	76.1
3) B Norm	---	---	0.0	0.0	0.0	0.0	39.9	39.0	14.4	9.3	---	---	102.6
4) A Norm	---	---	0.0	0.0	0.0	0.0	23.0	35.9	23.9	5.2	---	---	87.9
5) Wet	---	---	0.0	0.0	0.0	0.0	0.0	15.4	0.0	0.0	---	---	15.4
Average	---	---	0.0	7.7	7.9	8.3	29.3	32.1	11.2	5.5	---	---	101.9

D. Improvement Level 4; VERY HIGH Farm + VERY HIGH District
source: calculated = minimum(Step 3A., Step 7C. + Step 8D.)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Thousand Acre Feet Total
1) Critical	---	---	0.0	43.1	38.3	32.0	31.3	29.2	10.1	6.5	---	---	190.7
2) Dry	---	---	0.0	0.0	0.0	1.3	33.4	28.8	5.4	9.2	---	---	78.1
3) B Norm	---	---	0.0	0.0	0.0	0.0	46.3	46.1	14.4	11.1	---	---	117.9
4) A Norm	---	---	0.0	0.0	0.0	0.0	23.0	35.9	23.9	7.5	---	---	90.3
5) Wet	---	---	0.0	0.0	0.0	0.0	0.0	15.4	0.0	0.0	---	---	15.4
Average	---	---	0.0	11.3	10.0	8.6	29.3	32.1	11.2	7.0	---	---	109.4

E. Summary of Annual Capital and O&M Costs

	Capital Cost	Total Annualized
	1999 Costs (million $)	
Improvement Level 1; EXISTING Farm + HIGH District	41.32	6.85
Improvement Level 2; HIGH Farm + HIGH District	77.37	13.38
Impovement Level 3; HIGH Farm + VERY HIGH District	110.4	19.30
Improvement Level 4; VERY HIGH Farm + VERY HIGH D	144.6	24.85

CALFED Agricultural Water Use Efficiency
DRAFT Explanations and Examples of Targeted Benefits and Quantifiable Objectives

C-38

F. Summary of Combined Farm + District Quantifiable Objective

Improvement Level 1; EXISTING Farm + HIGH District

Year Type	Quantified Targeted Benefit Change	Agricultural Potential	Quantifiable Objective	Quantified Targeted Benefit Change Met
		Thousand Acre Feet		
1) Critical	239	73	72	30%
2) Dry	96	83	42	44%
3) B Norm	125	89	47	38%
4) A Norm	110	87	44	40%
5) Wet	15	90	15	100%
Average	128	83	47	37%
$/Acre Foot per year		$82	$120	

Improvement Level 2; HIGH Farm + HIGH District

Year Type	Quantified Targeted Benefit Change	Agricultural Potential	Quantifiable Objective	Quantified Targeted Benefit Change Met
		Thousand Acre Feet		
1) Critical	239	139	126	53%
2) Dry	96	177	73	76%
3) B Norm	125	187	87	70%
4) A Norm	110	180	80	73%
5) Wet	15	186	15	100%
Average	128	171	87	68%
$/Acre Foot per year		$73	$126	

Impovement Level 3; HIGH Farm + VERY HIGH District

Year Type	Quantified Targeted Benefit Change	Agricultural Potential	Quantifiable Objective	Quantified Targeted Benefit Change Met
		Thousand Acre Feet		
1) Critical	239	173	155	65%
2) Dry	96	188	76	79%
3) B Norm	125	195	103	82%
4) A Norm	110	195	88	80%
5) Wet	15	201	15	100%
Average	128	189	102	80%
$/Acre Foot per year		$87	$147	

Improvement Level 4; VERY HIGH Farm + VERY HIGH District

Year Type	Quantified Targeted Benefit Change	Agricultural Potential	Quantifiable Objective	Quantified Targeted Benefit Change Met
		Thousand Acre Feet		
1) Critical	239	222	191	80%
2) Dry	96	275	78	81%
3) B Norm	125	290	118	95%
4) A Norm	110	282	90	82%
5) Wet	15	297	15	100%
Average	128	268	109	85%
$/Acre Foot per year		$89	$157	

CALFED Agricultural Water Use Efficiency
DRAFT Explanations and Examples of Targeted Benefits and Quantifiable Objectives

C-39

Detail 121, Water Quality Stanislaus River

Step 1. Quantified Targets

A. Constituent: Diazinon (insecticide)

Natural source: No

Application period: dormant orchards and growing season on other crops

Durability: 39 day half life. Microbiological (aerobic and anaerobic) degradation in the soil is a function of pesticide, soil, soil temperature, soil water content and the micro-organisms present (CIBA-GEIGY Corporation, 1989).

Application method: dormant and foliar spray

Transport mechanism soluble, Surface or Ground Water Return

Crops	Affected	Existing	Assumed Affected
		acres	
Pasture	No	56,500	---
Vineyard	No	11,000	---
Alfalfa	Yes	9,700	4,850
Sugar Beet	No	500	---
Field	No	20,900	---
Rice	No	4,700	---
Truck	No	6,200	---
Tomato	No	800	---
Orchard	Yes	81,100	40,550
Grains	No	2,000	---
Cotton	Yes	---	---
Citrus/Olives	Yes	---	---
Total		193,400	45,400

The Assumed Affected acreage is 50% of the applicable crop. vategory. The 50% represents an estimate of the acreage that flows back to the Stanislaus River.

B. Regulatory limit: 0.04 ug L-1 (RWQCB, 1998) this is the Target concentration all times all year types

Step 2. Reference Condition

A. Maximum Diazinon Concentration on the Stanislaus at Ripon

source: USGS Circular 1159 (1998)   ug L^{-1}

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1) Critical	0.072	0.087	---	---	---	---	---	---	---	---	---	---

note: Diazinon data from the Merced River indicates that the concentration decreases to less than the regulatory limit after a peak in Feburary.

Merced (1993)	0.077	2.500	0.026	0.011	0.004	0.004	0.008	0.002	0.002	0.002	0.002	0.006